

What is claimed is:

1. Apparatus for transferring articles from a pickup station to a release station in a continuous motion, said apparatus being of the type which includes a plurality of pickup heads for picking up the articles at said pickup station and releasing the articles at said release station, and a vertical motion mechanism for moving said pickup heads to operative positions relative to the articles at said pickup and release stations, wherein said apparatus comprises:

a rotating turret which continuously rotates about a substantially vertical turret axis for continuously transferring the articles;

a plurality of reciprocating pickup heads carried by said turret for continuously and successively picking up groups of the articles at said pickup station and releasing the articles at said release station;

a conveyor having an arcuate conveyor section disposed generally below said pickup heads over which the heads are continuously rotated; and

one of said pickup and release stations being located along said arcuate section of said conveyor.

2. The apparatus of claim 1 wherein said turret moves said pickup heads in a closed curvilinear path around said vertical axis which includes a circular section and a linear pickup section along which said pickup heads move substantially in a linear motion to pickup the articles while said turret rotates.

3. The apparatus of claim 1 wherein said turret rotates said pickup heads in a circular path section, and said arcuate conveyor section has a curvature generally corresponding to said circular path section of said pickup heads.

4. The apparatus of claim 1 including a motion converter operatively associated with said pickup heads for causing said pickup heads to move generally in a straight-line motion along a pickup section to pick up the articles for transfer from said pickup station as said turret rotates.

5 5. The apparatus of claim 4 wherein said motion converter moves said pickup heads a linear distance which corresponds generally to a predetermined arc of rotation of said turret.

10 6. The apparatus of claim 5 wherein said motion converter moves said pickup heads along said linear pickup section a distance which corresponds generally to about 30 degrees of turret rotation.

15 7. The apparatus of claim 4 wherein said motion converter includes support frames carried by said turret, said pickup heads being slidably carried by said support frames to rotate about a swivel axis whereby said pickup heads swivel to maintain said straight-line motion along said pickup section.

8. The apparatus of claim 7 wherein said motion converter includes connector mechanisms operatively associated with said rotating turret and connected to said pickup heads for imparting a swivel and translatory motion to said pickup heads as said turret rotates whereby said straight-line motion is maintained.

20 9. The apparatus of claim 8 wherein said connector mechanisms include vertical cam shafts carried by said turret, linkage arrangements connected between said cam shafts and said pickup heads for imparting said motion to said pickup heads; and said linkage arrangements being slidably carried by said cam shafts to slide up and

down as said pickup heads reciprocate vertically during pick up and release of the articles.

10. The apparatus of claim 9 including a stationary support about which said turret rotates; cam followers connected to said linkage arrangements, and at least one cam carried by said stationary support which said cam followers follow to impart said straight-line motion to said pickup heads.

11. The apparatus of claim 1 wherein said release station is a case packing station located along said arcuate conveyor section; and said conveyor includes a case indexing conveyor for conveying indexed cases to said arcuate conveyor section and case packing station for receiving said released articles in synchronization with said rotating turret.

12. The apparatus of claim 11 including a plurality of transfer arms carried by said turret; said pickup heads being carried by said transfer arms; a plurality of grid heads having pivoting grid fingers arranged in a grid array corresponding to an array of the articles to be picked up, said grid fingers defining grid chutes having upper ends and lower ends for receiving the articles; said grid heads being carried by said transfer arms below said pickup heads; and said pickup heads having an array of article gripper elements arranged in a matrix corresponding to the array of grid chutes for gripping the articles.

13. The apparatus of claim 12 wherein said grid chutes have an open chute position wherein said lower chute ends are open for receiving the articles, said vertical motion mechanism is operatively connected to said grid heads for lowering said grid heads relative to said transfer arms over the articles in said open chute position; said

grid fingers having a closed position with the articles being held generally in said chutes, and including a grid actuator operatively associated with said grid fingers to cause said grid fingers to move between said open and said closed positions.

14. The apparatus of claim 12 including a motion converter operatively associated with said pickup heads and grid heads for causing said pickup and grid heads to move generally in a straight-line motion along a pickup section as the articles are picked up for transfer from said pickup station while said turret rotates.

15. The apparatus of claim 12 including a pickup head actuator mechanism for actuating said gripper elements to selectively grip and release the articles; wherein said pickup head actuator mechanism includes;

gripper actuators having movement between a closed position wherein the articles are gripped by said gripper elements and an open position wherein the articles are released by said gripper elements;

an actuator operator which controls said movement of said gripper actuators; and

an engagement member carried at said release station, and said actuator operator being arranged to strike said engagement member at said release station whereby said gripper actuators are moved to said open position for releasing the articles.

16. The apparatus of claim 15 including a latch operatively associated with said pickup heads for latching said actuator operator in said open position, and an unlatching device carried at said pickup station for unlatching said latch so that said gripper actuator moves to said closed position.

17. The apparatus of claim 1 wherein said pickup station comprises a case  
depacking station located along said arcuate conveyor section at which the articles are  
gripped by said pickup heads and removed from the cases, and said conveyor includes  
a case indexing conveyor for conveying cases containing the articles to said pickup  
station at prescribed intervals in synchronization with said rotating turret.

18. The apparatus of claim 1 wherein said vertical motion mechanism  
includes at least one circular cam carried around a stationary support disposed centrally  
of said turret; and a cam roller associated with each said pickup head which rides on  
said cam, said cam roller being interconnected to control the vertical position of said  
pickup head.

19. The apparatus of claim 18 including transfer arms circumferentially  
spaced around said turret; and wherein said vertical motion mechanism includes guide  
bearings slidably supporting said pickup heads on said transfer arms, and said cam  
roller being carried by one of said guide bearings and pickup heads.

20. The apparatus of claim 1 wherein said pickup heads include a plurality of  
gripper elements arranged in a matrix corresponding to an array of the articles to be  
picked up; said gripper elements being constructed and arranged to grip an upper  
portion of the articles; and including a pickup head actuator mechanism for actuating  
said gripper elements to selectively grip and release the articles; wherein said pickup  
head actuator mechanism includes;

gripper actuators having movement between a closed position wherein the  
articles are gripped by said gripper elements and an open position wherein the articles  
are released by said gripper elements;

an operator which controls said movement of said gripper actuators;

an engagement member carried at said release station, and said operator being arranged to strike said engagement member at said release station whereby said gripper actuators move to said open position for releasing the articles,

5 a latch operatively associated with said pickup heads for latching said gripper actuators in said open position,

and an unlatching device carried at said pickup station for unlatching said latch so that said gripper actuators move to said closed position.

21. The apparatus of claim 20 including a second engagement member carried at said pickup station for urging said actuator operator downward to remove pressure from said latch to aid said unlatching device in releasing said latch whereby said gripper elements grip the articles for pick up.

22. Apparatus for continuously transferring articles from a pickup station to a release station, said apparatus being of the type which includes a plurality of pickup heads for picking up the articles at said pickup station and releasing the articles at said release station, a vertical motion mechanism for moving said pickup heads to operative positions relative to the articles at said pickup and release stations, and an infeed conveyor for continuously conveying articles to the pickup station, said apparatus comprising:

20 a rotating turret which continuously rotates about a vertical turret axis and carries a plurality of article transfer arms in a circular path;

a plurality of reciprocating pickup heads carried by said transfer arms for picking up the articles at said pickup station and releasing the articles at said release station;

said turret continuously rotating said transfer arms in a circular path to continuously move said pickup heads and articles from said pickup station to said release station; and

a motion converter associated with said turret and operatively connected to said pickup heads for causing said pickup heads to move generally in a straight-line motion while said pickup heads grip the articles at the pickup station.

23. The apparatus of claim 22 wherein said motion converter moves said pickup heads a distance which corresponds to a predetermined arc of said turret rotation.

24. The apparatus of claim 23 wherein said predetermined arc is generally about 30 degrees of turret rotation.

25. The apparatus of claim 24 wherein said 30 degrees of rotation corresponds generally to 15 degrees about either side of a line perpendicular to a tangent to the circular path of said pickup heads.

26. The apparatus of claim 22 wherein said motion converter includes:  
support frames carried by said transfer arms for slidably carrying said pickup heads so that said pickup heads may swivel about a swivel axis relative to said support frames as said frames and pickup heads rotate about said turret axis; and

connector mechanisms interconnected between said rotating turret and said pickup heads for imparting swivel and translatory motion to said pickup heads on said frames.

27. The apparatus of claim 26 wherein said connector mechanisms include vertical cam shafts, linkage arrangements connected between said transfer shafts and

said pickup heads for imparting said motion to said pickup heads; and said linkage arrangements being slidably carried by said cam shafts to slide up and down as said pickup heads reciprocate vertically during pick up and release of the articles while carried by said turret.

5           28.    The apparatus of claim 27 including cam followers connected to said linkage arrangements, and at least one cam mounted to a stationary support disposed inwardly of said turret, and said cam followers engage said cam to impart said motion to said pickup heads.

10           29.    The apparatus of claim 28 wherein said release station is a case packing station where articles are deposited into cases, and including a case conveyor for conveying cases to said release station for receiving the released articles in synchronization with said rotating turret; wherein said pickup heads and case conveyor have a generally congruent arcuate path along which said pickup heads and cases move at said release station.

15           30.    The apparatus of claim 29 wherein said pickup heads include a plurality of article gripper elements for gripping the articles arranged in a matrix corresponding to an array of the articles to be picked up, and including;

          a pickup head actuator mechanism for actuating said gripper elements to grip and release the articles;

20           a plurality of grid heads having pivoting grid fingers arranged in a grid array corresponding to an array of the articles to be picked up, said grid fingers defining grid chutes having upper ends and lower ends for receiving the articles; said grid heads being carried by said transfer arms in alignment with said pickup heads; and said



pickup heads having an array of article gripper elements arranged in a matrix corresponding to the array of grid chutes for gripping the articles.

31. The apparatus of claim 30 wherein said grid chutes have an open chute position wherein said lower chute ends are open for receiving the articles, said vertical motion mechanism is operatively connected to said grid heads for lowering said grid heads over the articles in said open chute position; said grid fingers having a closed position with the articles being held generally in said chutes, and including a grid actuator operatively associated with said grid fingers to cause said grid fingers to move between said open and said closed positions.

32. The apparatus of claim 31 wherein said grid finger actuator includes a profiled body carried with said gripper elements which engages said grid fingers during relative movements between said grid heads and pickup heads to move said grid fingers to said open position and provide said open chutes for receiving the articles.

33. The apparatus of claim 32 wherein said pickup head actuator mechanism includes a fixed engagement member carried by said stationary support at least at said release station, and operators carried by said pickup heads which strike said engagement member at said release station whereby said operators actuate said gripper elements to release the articles.

34. The apparatus of claim 33 including a latch operatively associated with said pickup heads for latching said operators in said release position; and an unlatching device carried at said pickup station for releasing said latch so that said pickup heads grip the articles.

35. The apparatus of claim 34 including a second engagement member carried at said pickup station for urging said operators downward to remove pressure from said latch to aid said unlatching device in releasing said latch.

36. The apparatus of claim 35 wherein said gripper elements include gripper actuators acted upon by said operator, wherein said gripper actuators are normally biased in a gripper closing position unless acted upon by said operator whereupon said gripper actuators are moved to an open, release position.

37. The apparatus of claim 22 wherein said turret moves said transfer arms in a closed circular path, and carries said pickup heads along a linear pickup path at said pickup station, and a circular return path from said release station to said pickup station.

38. A continuous motion apparatus for packing articles into cases, said apparatus having an article feeder which continuously supplies articles to be picked up and packed into the cases, said apparatus comprising:

a pickup station where the articles are picked up and a release station where the articles are released for packing into the cases;

a turret which rotates continuously about a single vertical axis;

a plurality of transfer arms carried by said rotating turret for movement along a circular path;

a plurality of pickup heads carried by said transfer arms for picking up the articles at said pickup station;

a plurality of grid heads having pivoting grid fingers arranged in a grid array corresponding to an array of the articles to be picked up, said grid fingers defining grid

chutes having upper ends and lower ends for receiving the articles; said grid heads being carried by said transfer arms in alignment with said pickup heads;

said pickup heads having an array of article gripper elements corresponding to the array of grid chutes and the articles for gripping the articles;

5 a pickup head actuator mechanism for actuating said gripper elements to selectively grip and release the articles; and

a vertical motion mechanism for controlling relative positions of said pickup heads during transfer of the articles between said pickup and release stations as said turret rotates continuously about its vertical axis.

10 39. The apparatus of claim 38 including a motion converter operatively associated with said pickup heads and said grid heads for causing said pickup and grid heads to move generally in a straight-line motion along a pickup section to pick up the articles for transfer as said turret rotates.

15 40. The apparatus of claim 39 including a case conveyor for conveying empty cases to said release station, said case conveyor having an arcuate conveyor section disposed generally below a circular path over which said pickup heads are rotated at said release station; and wherein said circular path of said pickup heads is generally congruent with said arcuate conveyor section at said release station.

20 41. The apparatus of claim 39 wherein said motion converter moves said pickup heads a distance which corresponds generally to a predetermined arc of the turret rotation.

42. The apparatus of claim 39 wherein said motion converter moves said pickup heads along said linear pickup section a distance which corresponds generally to about 30 degrees of rotation of said turret.

43. The apparatus of claim 41 wherein said motion converter includes support frames carried by said transfer arms, said pickup heads and grid heads being carried by said support frames so that said pickup and grid heads swivel to maintain said straight-line motion along said pickup section.

44. The apparatus of claim 43 wherein said motion converter includes connector mechanisms associated with said rotating turret and said pickup and grid heads for swiveling said pickup and grid heads.

45. The apparatus of claim 44 wherein said connector mechanisms include a first linkage arrangement connected near one side of said pickup and grid heads and a second linkage arrangement connected near a second side of said pickup and grid heads for moving said pickup and grid heads to maintain said straight-line motion.

46. The apparatus of claim 45 including at least one fixed cam carried by a stationary support, and cam followers carried by said first and second linkage arrangements engaged with said cam for imparting said motion to said pickup and grid heads.

47. The apparatus of claim 46 wherein said first and second linkage arrangements include respective first and second vertical cam shafts connected to said cam followers, and lower arm links slidably carried by said first and second rotary motion transfer shafts connected to said pickup and grid heads.

48. The apparatus of claim 47 wherein said first and second linkage arrangements include upper arm links connected to said cam follower and to said first and second cam shafts.

49. The apparatus of claim 38 wherein said pickup head actuator mechanism includes an engagement member carried at said release station, and operators carried by said pickup heads which strike said engagement member at said release station whereby said operators are moved to a release position for releasing the articles.

50. The apparatus of claim 49 including a latch operatively associated with said pickup heads for latching said operators in said release position, and an unlatching device carried at said pickup station for releasing said latch so that said pickup heads grip the articles.

51. The apparatus of claim 50 including a second engagement member carried at said pickup station for urging said operator downward to remove pressure from said latch to aid said unlatching device in releasing said latch whereby said gripper elements grip the articles for pick up.

52. The apparatus of claim 51 wherein said first and second engagement members are carried in a fixed relationship by said turret wherein said engagement members are separated by an angle in a range of 100 to 180 degrees.

53. The apparatus of claim 38 including a stationary support about which said turret rotates; and wherein said vertical motion mechanism includes first and second cams generally encircling said stationary support, a first cam roller associated with each said pickup head which rides on said first cam and a second cam roller associated with

each said grid head which rides on said second cam whereby the vertical positions of said pickup and grid heads are controlled.

54. The apparatus of claim 53 wherein said vertical motion mechanism includes guide bearings slidably supporting said pickup and grid heads on said transfer arms, and said first and second cam rollers being carried by said guide bearings.

55. Apparatus for continuously transferring articles from a pickup station to a release station comprising:

a rotating turret which continuously rotates during said transfers;

a plurality of reciprocating pickup heads carried by said rotating turret for picking up the articles at the pickup station and releasing the articles at the release station;

a first conveyor for delivering the articles to said pickup station;

a second conveyor for delivering the articles away from said release station;

one of said first and second conveyors including an arcuate conveyor section disposed below a path of said pickup heads; and

one of the pickup and release stations being located at said arcuate conveyor section.

56. The apparatus of claim 55 wherein said second conveyor includes a case conveyor for conveying empty cases in which the articles are released and deposited, and said release station is disposed over said arcuate section of said second conveyor.

57. The apparatus of claim 56 including a motion converter operatively connected to said pickup heads to control movement of said pickup heads generally in a straight-line over a linear pickup section at which the articles are to be picked up.

58. The apparatus of claim 55 wherein said first conveyor includes a case conveyor for delivering cases containing the articles to said pickup station, and said pickup station is disposed over said arcuate conveyor section.

5 59. The apparatus of claim 55 including a vertical motion mechanism for controlling the vertical position of the pickup heads as they rotate with said turret, said motion mechanism including at least one circular cam attached to a stationary support; a cam roller associated with each said pickup head which rides on said cam as said turret rotates, and said cam roller being interconnected to control the vertical position of said pickup head.

10 60. The apparatus of claim 59 including grid heads disposed below said pickup heads having a plurality of guides arranged in a pattern for guiding the articles into the cases.

15 61. The apparatus of claim 60 wherein said vertical motion mechanism includes a second circular cam attached to said stationary support, and a cam roller associated with each grid head which follows said second cam second as said turret rotates.

62. Apparatus for continuously transferring articles from a pickup station to a release station comprising:

a rotating turret which continuously rotates about a single vertical axis;

20 a plurality of reciprocating pickup heads carried outwardly by said turret for continuously and successively picking up groups of the articles at said pickup station and releasing the articles at said release station;

an upstanding stationary support disposed inwardly of said rotating turret about which said turret rotates; and

a vertical motion mechanism operatively connected to said pickup heads and associated with said upstanding stationary support for controlling operative positions of said pickup heads during transfer of the articles as said turret and pickup heads continuously rotate.

63. The apparatus of claim 62 including a plurality of vertical transfer arms spaced circumferentially around said turret generally defining a turret cage surrounding said upstanding support; and said pickup heads being carried by said transfer arms.

64. The apparatus of claim 63 wherein said vertical motion mechanism includes a cam carried by and generally encircling said stationary support; and a cam roller associated with each said pickup head which rides on said cam, said cam roller being interconnected to control the vertical position of said pickup head.

65. The apparatus of claim 64 wherein said vertical motion mechanism includes guide bearings slidably supporting said pickup heads on said transfer arms, and said cam roller being carried by one of said guide bearings and pickup heads.

66. The apparatus of claim 65 wherein said pickup heads include a plurality of gripper elements arranged in pattern to pickup a group of the articles; and including a pickup head actuator mechanism having an operator for actuating said gripper elements to selectively grip and release the articles; and an engagement member carried by said stationary support at said release station arranged to strike said operator at said release station whereby said gripper elements release the articles.



67. A method of continuously transferring articles between a pickup station and a release station comprising:

continuously conveying the articles to a pickup station;

continuously picking the articles up at said pickup station using continuously moving pickup heads;

continuously rotating said pickup heads about a single vertical axis in a closed cyclic path which includes a circular section;

releasing the articles at said release station; and

providing an arcuate conveyor section, and carrying out one of said article pick up and release steps while the pickup heads are moving over said arcuate conveyor section.

68. The method of claim 67 including conveying cases containing articles to said arcuate conveyor section at prescribed intervals, and picking up the articles along said arcuate conveyor section from the cases for depacking the cases.

69. The method of claim 67 including releasing the articles over said arcuator conveyor section into cases conveyed along said arcuate conveyor section.

70. The method of claim 69 wherein said closed cyclic path of said pickup heads includes a linear pickup section along which said pickup heads move in a substantially straight-line motion to pick up the articles.

71. A method of continuously packing articles into a case comprising:

continuously feeding the articles to a pickup station;

providing a plurality of article pickup heads for picking up the articles at the pickup station;

continuously rotating said pickup heads about a vertical axis in a closed cyclic path which includes a circular path section and a linear pickup section;

causing said pickup heads to depart from a circular motion and move in a substantially straight-line motion at said pickup section to pick up the articles; and

5 releasing the articles from said pickup heads at said release station.

72. The method of claim 71 including releasing the articles at said release station which is disposed at an arcuate conveyor section below the circular path section of said pickup heads.

73. The method of claim 72 comprising conveying the cases to said release station on a case conveyor which includes said arcuate conveyor section.

74. The method of claim 73 including depositing the articles into the cases after pick up along an arc that ranges from 90 to 180 degrees.

75. The method of claim 72 comprising;  
providing pickup heads having a plurality of gripper elements arranged in an  
15 array corresponding to an array of the articles to be picked up;  
providing a plurality of reciprocating grid heads carried in alignment with said gripper heads wherein said grid heads include a plurality of guides arranged to guide the articles into partitioned cases;

20 moving said gripper and grid heads downward over the articles at said pickup station;

moving said grid heads in a motion relative to said gripper heads to pick up the articles;

moving said grid heads and pickup heads in a relative motion at said release station to guide the articles into said partitioned cases; and

releasing the articles from said pickup heads for passage through said grid heads into said partitioned case.